No. II.—ON AN ARBORICOLOUS NEMERTEAN FROM THE SEYCHELLES.

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(*Communicated by* J. Stanley Gardiner, *M.A., F.L.S.*)

(Plate 11 and Text-figure 24.)

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The single species of land-nemertean obtained by Mr. Stanley Gardiner in the Seychelles proves to be new. Apart from its bearing on the problems of geographical distribution, the chief interest of this species lies in its curious habitat. Like many of the land-nemerteans and turbellarians, it is found near the ground beneath the decaying bark of trees and in other moist spots; but it also occurs in a position not generally associated with this group of animals, viz. in the tree-tops. At the bases of the leaves of the screw-pine (*Pandanus Hornei*) is found a moist humus, which possesses a fauna of its own; and of the members of this fauna not the least interesting is *Geonemertes arboricola*. How it got there we do not know; but Mr. Gardiner has suggested to me that it may have been carried up by the seedling in its growth, and that the nemerteans living on a tree, 40–50 feet above the ground, are the direct descendants of those which the tree pushed skywards as it grew.

Through the kindness of Prof. Jeffrey Bell, I have been able to study specimens of the land-nemertean (*G. rodericana*) which Gulliver obtained in Rodriguez, and to add several points of anatomical detail which are not to be found in the original paper. To Professor Dendy I would express my gratitude for some notes on *G. australiensis* and for copies of his papers dealing with that form. My thanks are also due to my friend Mr. Forster Cooper for the sketch which forms the first figure of the Plate.

As the anatomy of more than one allied species has been studied very fully by von Graff*, Dendy †, and Coe ‡, I have not thought it necessary to go into great detail here. In the recent paper by the last-named author will be found a complete list of the papers which have hitherto appeared on this group.

Geonemertes arboricola, n. sp.

Localities. Chateau Margot, Mahé, Seychelles; 1600 ft. Cascade Forest, Mahé; from leaf-bases of *Pandanus Hornei*; about 1800 ft.

A small species, varying from about 15–25 mm. in length. Ground-colour (in life) pale whitish brown. The dorsal surface is marked by a deep purple-brown stripe in the

* Morph. Jahr., Bd. v. (1879). † Proc. Roy. Soc. Victoria, vol. iv. (1892).

‡ Proc. Boston Soc. Nat. Hist. vol. xxxi. (1904).

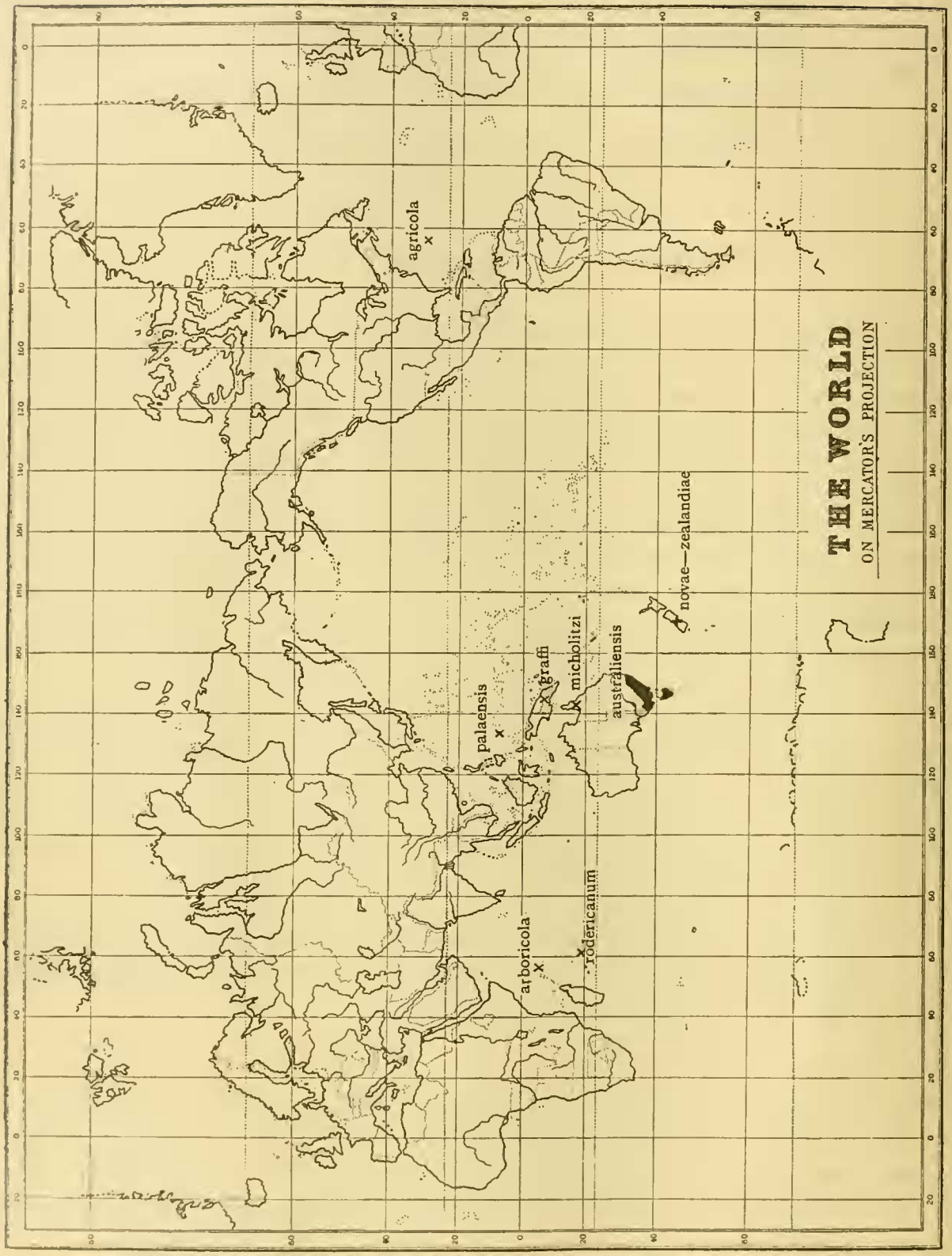

Fig. 24.—Distribution of Land-Nemerteans.

middle line and by vestiges of two lateral stripes at either end of the worm (*cf.* Pl. 11. fig. 1). The large proboscis, when extruded, is of about one-half the body-length.

The structure of the body-wall presents few features of special interest. The muscle-layers are somewhat poorly developed and the basement membrane is thin. Throughout the body cutis-glands are practically absent, except on the ventral surface in the region of the brain: here they are well developed, and over the area where they open to the exterior the basement membrane is much attenuated (*cf.* figs. 3 & 4). Connecting the openings of the two cerebral organs on the ventral surface is a very shallow groove lined by aglandular ciliated epithelium, similar in appearance to that lining the ciliated canals of these organs.

The cephalic glands are large and extend backwards past the brain into the region of the stomach (*cf.* figs. 2–5, *gl.c.*). The great development of these glands is characteristic of land-nemerteans, and is doubtless connected with the necessity of keeping the body-surface moist. The cutis-glands found in other groups are practically absent in the Metanemertea, and their place is taken by the greatly enlarged cephalic glands in these cases where a considerable amount of slime is necessary for the well-being of the worm.

The small œsophagus opens into the rhynchodæum immediately in front of the brain. The stomach is large, and on either side of it the first intestinal gut-pouch extends forwards. Neither gut-pouches nor stomach reach forward so far as the brain.

The proboscis is large and contains 19 nerves in each of the three specimens examined. Four reserve stylet-pouches are present. Unfortunately the stylets were in each case dissolved away. The proboscis-sheath extends to the extreme posterior end. In section, the muscles on the dorsal side of the sheath are here and there much swollen (*cf.* fig. 6), recalling the condition described by Bergendal for *Callinera bürgeri*. In the present species the appearance is much less definite, varying irregularly with the individual and with the different regions of the body

The worms are hermaphrodite. The testes are found between the nerve-cords, and the ovaries dorsal to them (*cf.* fig. 6). Each ovary, when fairly mature, contains a single large ovum. The yolk is apparently provided by the follicle-cells, which are enlarged on the intestinal side of the ovary and full of yolky material. With the syncytium formed by these cells, the ovum enters into communication by several wide protoplasmic bridges (fig. 7). Through these the yolky matter formed by the follicle-cells apparently flows into the ovum. The condition recalls the remarkable arrangement in *Drepanophorus borealis* *, where each follicle-cell elaborates yolky material and conveys it to the ovum by a spout-like process. A yolky thickening of the follicular layer was observed by Dendy in *G. australiensis* †, though he does not appear to have observed any direct communication between the cells of this layer and the ovum. In *G. agricola*, Coe ‡ has shown that the yolk is provided by absorbed ova instead of by the follicle-cells. Speaking generally, the follicle-cells would appear to become the active providers of yolk where the ova are exceptionally large.

* Punnett, Proc. Zool. Soc. 1901, ii. p. 105.

† *Loc. cit.* p. 114.

‡ *Loc. cit.* p. 548.

TABLE.

	Size.	Colour.	Eyes.	No. of reserve stylet-pouches.	Sex.	Frontal organ.	Accessory lateral nerve.	Excretory system.	Proboscis nerves.	Remarks.
agricola	40–50 mm.	Whitish, brownish, or orange.	4	2	☿	Highly developed.	Absent.	Present.	13–15	Cerebral sense-organ small, in front of brain.
chalicophora	12 mm.	White, reddish anteriorly.	4	2	? ☿	Small or wanting.	,,	,,	12	Calcareous bodies in integument and parenchyma.
nova-zealandiæ	37–53 mm.	4 purplish-brown stripes.	4	4	? ♂ + ♀	?	?	?	?	
australiensis	40 mm.	Yellow, brown, or orange.	many	2	♂ + ♀	Small or wanting.	Present.	Present.	18	Glandular portion of cerebral sense-organ extends beyond brain.
graffi ..... / *micholitzi*	150 mm.	4 dark brown stripes separated by whitish lines.	4	2	? ♂ + ♀	Very large.	,,	? Absent.	23	
palaensis	40–50 mm.	Reddish, dark brown stripe.	6	4	☿	Conspicuous.	,,	? Absent.	19–21	
rodericana	27–75 mm.	Dark green, with fine white lines.	2–4	4	♂ + ♀	Large.	,,	Absent.	19–21	
arboricola	15–25 mm.	Whitish brown, with purple-brown stripe.	2–4	4	☿	,,	,,	,,	19	

The nervous system is arranged on the usual metanemertean plan. Giant neurochord-cells are apparently absent. The most remarkable feature is the presence of the accessory lateral nerve (*cf.* Pl. 11. figs. 5 & 6). This nerve is characteristic of certain species of *Geonemertes* (*cf.* Table, p. 60), and takes its origin from the posterior median surface of the dorsal ganglion ; whereas the lateral nerve proper is, of course, a continuation of the ventral ganglion. The accessory nerve is found in the same sheath as the lateral nerve, and on its dorsal surface. At the tail end the lateral nerves form a well-marked supra-anal commissure, and this also occurs in *G. rodericana*.

The cerebral organ is small and opens on the ventral surface just in front of the brain (fig. 3). A well-marked frontal organ exists. In all specimens examined there are two large ocelli near the tip of the snout (fig. 2). In some specimens there are also found what I take to be vestiges of another pair, but as they are small and destitute of pigment it is difficult to speak positively of their precise nature.

The land-nemerteans of the world, though few in number, are not without importance in questions of geographical distribution; and no notice of a new species would be adequate without some account of its relations to the other members of the group. Coe has recently given a valuable synopsis of what is known about the genus *Geonemertes*; and the Table on p. 60 is an amplification of the Table which accompanies his memoir. From this Table it is obvious that the nearest allies of *G. arboricola* are *G. palaensis* from the Pelew Islands and *G. rodericana* from Rodriguez. *G. arboricola* differs from the former in the number of ocelli, from the latter in being hermaphrodite, and from both in its colour-pattern. In most features, however, it resembles them closely. With *G. graffi* * it also agrees in the presence of the accessory lateral nerve and in the absence of an excretory system. Moreover, all these forms are striped. It is not impossible that *G. novæ-zealandiæ* may turn out to belong to the same group when more is known about it. *G. australiensis* resembles the forms mentioned in the presence of an accessory lateral nerve, but differs in having an excretory system; for, as is well known, it was in this species that Dendy demonstrated the existence of flame-cells. The remaining two species, *G. agricola* and *G. chalicophora*, form a group apart from the rest, and are characterised by the absence of the accessory lateral nerve, the presence of an excretory system, and the small number of proboscis-nerves. To place these two forms in a separate genus would doubtless give a truer idea of their affinities; but the number of land-nemerteans is at present small, and it seems better to await further discoveries before taking such a step. I am inclined to consider that the species *palaensis*, *graffi*, *rodericana*, and *arboricola* have arisen independently from some marine form. The form I would suggest as nearest to this hypothetical form is *Prosadenoporus*, which is remarkable in possessing no excretory system and in being only found in the Indian Ocean. It is possible that *novæ-zealandiæ* and *australiensis* may also have arisen from this form. On the other hand, I consider that *agricola* and *chalicophora* have arisen from some form not far removed from the genus *Amphiporus*.

* I regard *G. micholitzi* as belonging to the same species as *G. graffi*. The differences upon which Bürger separates the two appear to me unessential (Zool. Jahr., Abth. f. Syst. Bd. ix. pp. 272–4).

Lastly, with regard to the question of the origin of land-nemerteans—whether they have arisen from freshwater forms, as Montgomery * has supposed, or directly from marine species. Coe points out that the absence of fresh water in the Bermudas suggests a direct marine origin for *G. agricola*; he also says that it can live in salt water but not in fresh. In the matter of marine origin, I agree with Coe. The freshwater streams in the Seychelles are small and abound in torrents. It is difficult to conceive how a nemertean could have made its way up to 1500–2000 feet by such a passage.

EXPLANATION OF PLATE 11.

b.m. = basement membrane.
b.v. = blood-vessel.
c.c. = ciliated canal of cerebral organ.
c.or.gl. = gland of cerebral organ.
d.c. = dorsal commissure of brain.
d.d.g. = dorsal lobe of dorsal ganglion.
d.g. = dorsal ganglion.
fr. = frontal organ.
gl.c. = cephalic glands.
int. = intestine.
l.n. = lateral nerve-cord.
l.n a. = accessory lateral nerve.
m. = muscle-fibres.
m.l. = longitudinal muscular layer.
m.c. = circular muscular layer.
n.c. = cephalic nerves.
oc. = eye.
œs. = œsophagus.
ov. = ovary.
pr. = proboscis.
p.s. = proboscis-sheath.
rhd. = rhynchodæum.
t. = testis.
v.c. = ventral commissure.
v.g. = ventral ganglion.

Fig. 1. Sketch of preserved specimen. × 3.
Fig. 2. Transverse section near tip of snout. × 90.
Fig. 3. Transverse section immediately anterior to the commencement of the brain. × 90.
Fig. 4. Transverse section through brain-region. × 90.
Fig. 5. Transverse section through œsophageal region behind the brain but before the commencement of the stomach. × 67.
Fig. 6. Transverse section through about the middle of the animal's body. × 17.
Fig. 7. Ovary containing a single ovum attached by two wide processes to the follicle-cells. On the outer side is to be seen the commencement of the oviduct, which is not yet completely formed. × 120.

* Journ. Morph. vol. ii. (1895).